Big Data/Data Analytics
Best-in-Class Radar Detection

Introducing EVO RADAR

- Only 2 Sensors Needed Per Intersection, Great Value
- Simple to Set Up & Use
- 900' of Detection Approach Area
- Departure Detection
- Pedestrian Detection
- Bike Detection

To learn more, visit www.econolite.com.
SIDRA INTERSECTION 9

Award-winning environmental analysis method for assessing intersection and network traffic solutions - for transportation planners and engineers

Easily compare alternative traffic solutions according to CO$_2$ emissions using a unique power-based vehicle energy and emission model combined with a powerful lane-based intersection and network traffic model.

Highly accurate four-mode elemental model using detailed vehicle path modeling based on work that won the Institute of Transportation Engineers 1986 Transportation Energy Conservation Award for research into energy savings from urban traffic management.

To learn more, visit sidrasolutions.com/environmental-analysis
Big Data, Big Picture

“Combine a ton of data with some analysis for grand results”—that’s the promise of big data, according to Jonas P. DeMuro in a December 2019 article in TechRadar.com. In the transportation realm, the ability to provide context to travel data seems like one of the greater opportunities of big data and analytics. However, big data can be nebulous, and our members have numerous questions as summarized in the article on ITE’s Big Data Listening Sessions on page 24.

To illustrate the concept, my philosophy for workout tracking and contribution to a large pool of activity data is: if it’s not on Strava, it didn’t happen. Strava is one of many GPS-based exercise trackers that maps and analyzes activities. In aggregate, Strava and similar systems provide data on where and when walkers, runners, and bikers access the transportation system. The beauty of this data resource is that it is continuous and touch-free.

There are no sensors to maintain, it is updated consistently, it covers a significant area, and it has a large sample size.

But beyond spatial and temporal data, other insights are conceivable, including: the age of active neighbors, purchases associated with activity, adverse weather impacts on activity, arterial crossing frequency, and property values correlated to activity. In a December 2020 article for Tech Republic, Mary Shacklett writes, “One of big data’s soft spots is the inability to identify impactful business cases that build revenue, reduce costs, and improve operations.”

Herein potential exists. As the system experts, transportation professionals can work with data specialists to refine business cases.

A few cautions are necessary, though. Computers and machine-derived outcomes are not inherently neutral. As human creations, they are wholly subject to human error and bias. Further, algorithms are built on existing data and predict trends accordingly. If there is a flaw in the raw data, an under-represented stakeholder for instance, the algorithm is likely to perpetuate it. In an October 2011 article in the MIT Technology Review, Erica Naone notes, “About 40 percent of Twitter’s active users sign in to listen, not to post, which…suggests that posts could come from a certain type of person, rather than a random sample.” Similarly, in my Strava example, I self-selected to provide data to the system as a function of my need for usage. Herein, the system’s accuracy might be a significant flaw in the raw data, not in the system itself.

Further, algorithms are built on existing data and predict trends accordingly. If there is a flaw in the raw data, an under-represented stakeholder for instance, the algorithm is likely to perpetuate it. In an October 2011 article in the MIT Technology Review, Erica Naone notes, “About 40 percent of Twitter’s active users sign in to listen, not to post, which…suggests that posts could come from a certain type of person, rather than a random sample.” Similarly, in my Strava example, I self-selected to provide data to the system as a function of my need for usage. Herein, the system’s accuracy might be a significant flaw in the raw data, not in the system itself.

In the transportation realm, the ability to provide context to travel data seems like one of the greater opportunities of big data and analytics. However, big data can be nebulous, and our members have numerous questions as summarized in the article on ITE’s Big Data Listening Sessions on page 24.

To illustrate the concept, my philosophy for workout tracking and contribution to a large pool of activity data is: if it’s not on Strava, it didn’t happen. Strava is one of many GPS-based exercise trackers that maps and analyzes activities. In aggregate, Strava and similar systems provide data on where and when walkers, runners, and bikers access the transportation system. The beauty of this data resource is that it is continuous and touch-free.

There are no sensors to maintain, it is updated consistently, it covers a significant area, and it has a large sample size.

But beyond spatial and temporal data, other insights are conceivable, including: the age of active neighbors, purchases associated with activity, adverse weather impacts on activity, arterial crossing frequency, and property values correlated to activity. In a December 2020 article for Tech Republic, Mary Shacklett writes, “One of big data’s soft spots is the inability to identify impactful business cases that build revenue, reduce costs, and improve operations.”

Herein potential exists. As the system experts, transportation professionals can work with data specialists to refine business cases.

A few cautions are necessary, though. Computers and machine-derived outcomes are not inherently neutral. As human creations, they are wholly subject to human error and bias. Further, algorithms are built on existing data and predict trends accordingly. If there is a flaw in the raw data, an under-represented stakeholder for instance, the algorithm is likely to perpetuate it. In an October 2011 article in the MIT Technology Review, Erica Naone notes, “About 40 percent of Twitter’s active users sign in to listen, not to post, which…suggests that posts could come from a certain type of person, rather than a random sample.” Similarly, in my Strava example, I self-selected to provide data to the system as a function of my need for data. Not everyone cares to do so. Further, I have leisure time, live in a neighborhood that is conducive to outdoor recreation, and have the means to purchase gym memberships. These factors limit extrapolation of Strava data to the greater population.

Big data also presents resource allocation challenges. Typical transportation agencies may not have the technology or talent to dive into the data lake. “It is complicated and costly to access usable information fast enough to make a difference,” Jamie Carter pens in a January 2016 article for TechRadar.com, and experimentation requires iteration. And while people are willing to offer information to private companies, there is a distrust of data in the hands of government. This offers opportunities to partner with universities, expand student chapters, create public-private-partnerships, and develop interest in the transportation field within other sectors.

Big data opportunities abound. With consideration and caution, ITE professionals can enrich the resources used to model our communities.

Alyssa A. Rodriguez, P.E., PTOE (F)
ITE International President
Big Data/Data Analytics

24 Making the Most of Big Data and Data Analytics
By Shawn M. Turner, P.E. (M)

28 Big Data Applications for Managing Roadways
By Jijo K. Mathew, Jairaj C. Desai (S), Rahul Suryakant Sakhare (S), Woosung Kim, Howell Li, and Darcy M. Bullock (M)

37 Impact of Navigation Applications on Traffic Operations
By Scott Poska, P.E., PTOE, RSP1 (F), Andrew Kaplan, P.E. (M), and Jennifer Alford, P.E., PTOE (M)

43 Parking Requirements for Limited-Service Hotels
By John W. Dorsett, AICP
For Students, By Students

This month the first ever International Student Leadership Summit (SLS) will be held virtually, engaging student members from across ITE. The concept of SLSs originated in the Western District when students at Cal Poly San Luis Obispo had the idea of holding a conference organized exclusively “for students, by students.” With the support of ITE professionals—most notably, ITE International Past President, Zaki Mustafa—the first SLS was held February 15-17, 2014, with 85 students attending from 11 universities.

Over the last six years, the idea has spread throughout ITE, with SLSs being held regionally around the United States as well as in Canada and Australia. For students undertaking an SLS, the challenge is significant—to organize a multi-day event at your university for scores of students, providing not only an engaging program, but also food and lodging, all at a nominal cost. For those who have been involved as volunteers helping to host ITE events, you understand the work that goes into a simple lunch or dinner meeting, never mind a multi-day affair. And don’t forget these are full-time students working on undergraduate or graduate degrees.

Having attended a number of the SLSs, I am always impressed with the leadership abilities and organizational skills demonstrated by our ITE student members. While they receive advice and support from their faculty advisors and local ITE members, the heavy workload rests with the students. The ITE Legacy Fund and often a sponsoring District provide seed money, but the bulk of the cost of the SLS comes from student fundraising. The SLS allows students to take their student membership experience to the next level and hone the non-technical skills—communication, teamwork, logistics, marketing, budgeting, contracting for services, etc.—helping them as they move into their professional careers.

With all of these benefits in mind, and recognizing that many of the normal ITE student activities have been curtailed by COVID-19, ITE International staff, led by ITE Associate Executive Director and Senior Director of Membership Strategies and Operations Colleen Agan, are working with students from 15 student chapters from across the United States and internationally to deliver this year’s virtual International SLS on February 19-20. While ITE Headquarters will be helping with the logistics, the development of the content for the event and the leadership of the sessions will rest with the students—staying true to the idea of an event “for students, by students.”

I encourage you to take a minute to check out the program at www.ite.org/virtualsls. As you will see, it includes a wide-range of engaging session topics and speakers, including ITE International President Alyssa Rodriguez, P.E., PTOE (F) moderating the Opening Session panel discussion on leadership.

I am very pleased with how well ITE has adapted to our virtual environment in the midst of COVID-19. While there is certainly something lost when we cannot be together in-person, there is also something to be gained when we can connect members from around a region or around the world in numbers and ways that are not possible face-to-face. This year’s International SLS is a great example with our students leading the way. Stay tuned for more great ITE events to come in 2021—both virtual and in-person. In the meantime, connect with me on the ITE e-Community or on Twitter: @JPaniatiITE.

Jeffrey F. Paniati, P.E. (F)
Executive Director and Chief Executive Officer
ATC CABINETS
INTELLIGENT. SECURE. PROVEN.

Utilizing hi-density, smart components and combining the best of existing standards with the latest technology, McCain’s, forward-thinking ATC Cabinets are ready for today’s smart cities and the future of connected vehicles. With 2K+ units deployed, McCain’s ATC Cabinets are the smart choice for smart cities.

SMART SOLUTIONS FOR SMART CITIES
- DYNAMIC MESSAGE SIGNS
- PARKING GUIDANCE & WAYFINDING
- SIGNAL PERFORMANCE MEASURES/ANALYTICS
- INTERSECTION CONTROL SOFTWARE
- ATC CABINETS

#ITE #SmartCities #ATCCabinets
www.mccain-inc.com
PEOPLE IN THE PROFESSION

Obituaries

ITE recently learned of the passing of the following member. We recognize her contributions to ITE and the profession, and send condolences to her family.

Roberta P. Dwyer, P.E., PTOE of Duluth, MN, USA passed away on July 14, 2020.

New Members

ITE welcomes the following new members who recently joined our community of transportation professionals.

Canadian
Matthew Roj
Jennifer Armstrong
Shawn Smith
Elizabeth Murphy
Frank McKinney
Andrew Cuvaj, C.E.T.
Agnieszka Pasko
Roumen Kotev, C.E.T.

Missouri Valley
Edward Dührberg, P.E.
Kenneth Dedering, P.E.
Ryan Campbell, P.E.
Tim Hums, E.I.
Shannon Callahan
Brooke Barrett
Minghua Qiu Miller, P.E.

Florida Puerto Rico
Shawn Pope

Global
Tanya Joubert
Andrew Buruma
James Ogutu Alo

Great Lakes
Dan Farnsworth
Benjamin Chavez, P.E.
Christian Lawien, P.E.

Mid-Colonial
James K. Schmid
Woon Kim
Benjamin Ilias
Evan M. Baker
Mohammad Habibi
Andrew Hayes
Ralph Gann
Micah Payne
Andrew Manalastas

George Loyd
Darren Ujano, P.E.
Nichol Ingram

Western
Chin Su Taing, PTP, RSP
Megan Amber Gee
Sierra Brown
Crystal Franco
Tera Haramoto
Youn Sim
Jerry Asabor
Juan Cortes
Nathan Gima
James Harris
Alan Nino
Nawar Saleh
Raul Alvarado
Mauricio Castaneda
Sharen H. Cho-Ibanez, P.E.
Reid Tokuhara, P.E.
Peter Chan, P.E.
Ruben Nunez
Phucly Hong Tran
Mark Lancaster
Nicole Ogan

Virginia

Letters in parentheses after individuals’ names indicate ITE membership status: S - Student Member; IA - Institute; M - Member; F - Fellow; R - Retired Member; and H - Honorary Member. Information reported here is based on news releases, and other sources. If you have news of yourself or the profession that you would like considered for publication, please send it to Holly Stowell, hstowell@ite.org.
Reminder: What’s New for 2021
There are lots of exciting events, activities, and opportunities at ITE this year. Here’s a reminder about What’s New for ITE in 2021:

Virtual Student Leadership Summit
ITE student leaders from 15 universities across all of ITE are organizing a unique virtual student meeting experience. During this two-day conference, session topics will cover purposeful leadership, career advice, transportation technology, sustainability, equity, and more. The program maximizes interactive opportunities, planning for small group discussions, a team STEM competition, and a Soapbox session to share what you care about most. Registration is open and the agenda and sessions descriptions are available online. Access the most up to date information and register at www.ite.org/virtualsls. The Early Bird Deadline is February 5, 2021. Registration is $10 for students, $25 for professionals, and $50 for non-members. All registration fees collected will be used to support the ITE Diversity Scholars Program.

Vision Zero Sandbox Competition
ITE is hosting a sandbox competition, fully supported by the ITE Consultants Council, which will focus on Vision Zero Data Analytics. The challenge is to demonstrate how automated conflict data being collected through innovative technologies can be used to gain new insights into safety problems and the selection of low-cost countermeasures at intersections. Data from six different intersection types will be provided and the teams/individuals will be asked to select three intersections and identify countermeasures. There will be separate professional and student categories. Teams can include an unlimited number of participants, but at least one member of the team must be an ITE member. The winning teams will be presented with an ITE Vision Zero Sandbox Competition Award at the ITE Annual Awards Luncheon in Portland, OR, USA on July 20, 2021. Expressions of interest are requested by February 15 but are not a requirement. Submissions are due April 15, 2021. For more visit www.ite.org/sandboxcompetition.

ITE Young Leaders to Follow for 2021
Help us recognize and highlight younger ITE members who are making an impact on ITE at the Chapter, Section, District, or International levels and in their profession. This group will include our District Rising Stars. Anybody can make a nomination: employers, peers, mentors, colleagues, and self-nominations are encouraged. Nominations are due March 15, 2021. For eligibility requirements and to nominate a young leader, go to www.ite.org/youngleaders.

Transportation Transforms Communities Video Competition
Your Mission: Create a short video (2 minutes or less) that celebrates the transportation industry, educates the public about the many exciting facets of transportation, and emphasizes safety, inclusion, equity, and other values that enhance/positively impact our communities. Entries can be submitted between February 1 and May 1, 2021. All the details are available at www.ite.org/video-challenge.
WHERE IN THE WORLD?

Can you guess the location of the “Where in the World?” photo in this issue? The answer is on page 50. Feel free to send in your own photos to hstowell@ite.org. Good luck! 

Go Green with ITE Journal

Not in the office to get your mail, or would you like to be more “green”? You can choose to stop the mailed delivery of ITE Journal by filling out a quick online survey at http://bit.ly/ITEJGoGreen. You will still get the emailed version of ITE Journal that goes out on the first or second of each month and have full access to the digital edition.

ITE HAS THE TALENT.

The ITE Career Center is your online resource for qualified transportation professionals.

EXPERIENCED | QUALIFIED | TALENTED

www.ite.org/jobs
2021 EVENTS

ITE VIRTUAL STUDENT LEADERSHIP SUMMIT
February 19-20
Visit www.ite.org/virtualSLS for more information.

ITE VIRTUAL TECHNICAL CONFERENCE
March 23-24 | See page 28 for details.

MOVITE SPRING MEETING
April 8 | Virtual Meeting

SDITE VIRTUAL ANNUAL MEETING
April 12–16

MID-COLONIAL DISTRICT ANNUAL MEETING
April 26–28 | Virtual Meeting

TEXAS SPRING MEETING
May 5-7 | Corpus Christi, TX, USA

NORTHEASTERN DISTRICT ANNUAL MEETING
May 13–14 | Virtual Meeting

INTERMOUNTAIN SECTION ANNUAL MEETING
May 13–15 | Jackson, WY, USA

CITE ANNUAL CONFERENCE
June 8–10 | Virtual Meeting

FLORIDA PUERTO RICO SUMMER MEETING
June 23–25 | Fort Lauderdale Beach, FL, USA

JOINT ITE INTERNATIONAL AND MOUNTAIN AND WESTERN DISTRICTS ANNUAL MEETING AND EXHIBITION
July 18–21 | Portland, OR, USA

GREAT LAKES DISTRICT ANNUAL MEETING
August 30–31 | Columbus, OH, USA

Thank You, Enterprise Rent-A-Car

ITE gratefully acknowledges Enterprise Rent-A-Car for its generous contribution of $20,000 to the ITE Legacy Fund.

This donation from Enterprise Rent-A-Car enables ITE to continue to help develop the next generation of leaders within ITE and the transportation profession as part of ITE’s mission for inclusion and diversity. The Legacy Fund supports scholarships and programs that provide enriching opportunities for future leaders.

ITE is pleased to welcome Enterprise Rent-A-Car to its Legacy Society at the Trailblazer level.

www.ite.org
Congratulations to the Newest TPCB Certificants!

The Transportation Professional Certification Board, Inc. (TPCB) and ITE congratulate the following 76 new Professional Traffic Operations Engineers (PTOE), 12 Professional Transportation Planners (PTP), 48 Road Safety Professionals–Level 1 (RSP1s), and 5 Road Safety Professionals–Level 2 (RSP2s, Behavioral or Infrastructure) who passed the certification exams in the October 2020 exam period. To learn more about these certifications and how to apply, visit www.tpcb.org. The next application deadline for the June 2021 exam period is April 2, 2021.

PTOE
Aaron Michael Van Aken
Joseph J. Bartus
Kent James Blunt
Andrew S. Brewer
Luana Clara Ozelim Broshears
Ashley Marie Carpenter
Rinal Komal Chheda
Asha Parveen Chittoor
Brent Edward Cook
James Willis Cook
Michael Allan Corwin
Kelly Dunne
Thomas Vincent Flask
Matthew Ryan Fralick
Sterling James Frazier
Jeffery Scott Gordon
Joshua Evans Green
Stephanie Lee Phillips Gros
Lawrence Guan
Ravindra Gudishala
Sunil Gyawali
Shiva Haji Hashemi
Charles Huston Hergesheimer, III
Aung Htay Hlaing
Md Sakoat Hossan
Donna Mary Howes
Azzam Jabsheh
Dennis Michael Jordan
Christina M. Karanikolas
James Bradley Kay
Matthew McLawhorn Kennedy
Alexander Sloan Kerr
Michael Jeffrey Kinnard
Bidoura Khondaker
Kara Ann Kosiske
Kelly Michelle Kosino
Smita Kundur
Mary Lee
Edgar Leon
Dongmei Lin
John W. Lockaby, Jr.
Derek L. Lyman
Dimitra Panagiota
Diana Maragakis
Claire Elizabeth McGinnis
Marshall R. Metcalf
Michael W. Monroe
Brent J. Muscha
Asnake Z. Negussie
Daniel Ohrenstein
Spencer Lee Osborn
Shivraj Sarjerao Patil
Rajan Paradkar
Ravi Kiran Puvvala
James Wellington Parkhill
Shashikant Bhagvandas Patel
Jayakrishna Patnaik
Vikas Ravada
Vishal Reddy Sarikonda
Jay Patrick Snyder
Anna Joan Snook
David Michael Stanek
Matthew D. Stoutz
Salowa Sultana
Xin Sun
Eric Zi Yue Tam
William Edward Todd, III
Naveen Kumar Veeramisti
Cole G. Villalobos
Merih Wahid
Michael Sean Walsh
Sarah Michelle Walter
Yilin Wang
Alexander L. Wolfson
Jeffrey R. Young
Ce Zhang
Xi Zhou

PTP
Nathan L. Becknell
Medora Ann Kealy Bornhoft
Phillip Cherry
Heather Hector
Tyce Herrman
Darrell L. Howard
Wade Kline
Subba Reddy Munagala
Peter Scholz
Max Emanuel Schwartz
Yishu Wei
Heather Whitmore
RECOGNIZING OUR FUTURE:

Young Leaders to Follow for 2021

Let’s shine a spotlight on the best young professionals in ITE and the profession. We are looking for the top young members to recognize as the ITE Young Leaders to Follow for 2021, a group of 20 young members that represent the best of our emerging leaders.

Help us cast a wide net across all of ITE and the industry to find the best of the best among up-and-coming professionals. Nominate a young leader today! Employers, peers, friends, colleagues, and mentors can all nominate, and you can also self-nominate.

Eligibility: Candidates must be an ITE member and 35 years of age or younger on January 1, 2021.

Nominate a Young Leader Today! The application deadline is March 15, 2021. For all the details, visit www.ite.org/youngleaders.
Call for Data


The 11th Edition of the ITE Trip Generation Manual will be released in the fall of 2021 along with an updated ITETripGen web app. By then, ITE anticipates that the quantity, mode, and time-of-day distributions for site-generated trips will have stabilized to the next stage of post-pandemic "normal." We expect some of the COVID-19 induced changes—such as the dramatic increase in the proportion of the workforce that chose or was directed to work-from-home in 2020—will stabilize at new lower values. The increased reliance on delivery services will continue. Social distancing cautions will linger and continue to affect trip-making at restaurants and entertainment venues. The perceived safety, comfort, and benefits in the personal use of transit and ridesharing will improve and trip-making modal shares will trend back toward pre-pandemic levels, but this recovery may take months and years.

The 11th Edition will provide guidance on the estimation of post-pandemic site-generated trips. For some combinations of land use type and time period, pre-pandemic (e.g., 2015-2019) data may continue to be appropriate. For other combinations, adjustments will be necessary.

For prior editions, ITE has typically posted a Call for Data that highlighted new or emerging land uses as high priorities. For this edition, ITE requests that its members submit data for any land use for the years 2017 through 2021. In order to develop tools that optimize ITE members’ ability to estimate trip generation, ITE needs a robust database with trip...
generation counts across the entire gamut of conditions (pre-pandemic, mid-pandemic, and post-pandemic).

- If you have counted site-generated trips for any land use within the past five years, please consider submitting the data for use in the 11th Edition.
- If you have compiled trip generation data collected by others for any land use within the past five years, please consider submitting the data. ITE will track down the source and obtained their permission before using the data.
- If you know of any trip generation data collected or compiled by others, let us know the agency or consulting firm (and a potential contact if possible). ITE will track down the source.

Submit the data via the ITE website www.itedatasubmission.org, or contact Lisa Fontana-Tierney, Traffic Engineering Senior Director at lfontana@ite.org with any questions.

The deadline for data submission is May 1, 2021. ITE encourages you to start reviewing your files now for potential data.

The ITE Trip Generation Manual is a critical resource used throughout North America. The ability to develop relationships that explain COVID-related effects on site-generated trips depends on the quantity and quality of trip generation study sites in our database. Thank you in advance for your help. **itej**
Keeping Up Momentum

When you take a close look at the accomplishments and activities of the Washington, DC Section of ITE (WDCSITE), it’s easy to see why the Section won the 2020 ITE Section/Chapter Momentum Award. In 2019, the Section increased average attendance at meetings by more than 21 percent, and saw a 76 percent increase in total event attendance. A global pandemic has not deterred the Section from keeping its members engaged. When COVID-19 related restrictions struck in March 2020, the Section quickly pivoted to offering virtual meetings—first for its Board, which has continued meeting monthly throughout the pandemic, and then for its first virtual Section meeting in May. The Section got creative and comfortable with the nontraditional format, planning activities like a virtual background contest to inject a spirit of lightheartedness and community.

Once the world safely emerges from COVID, WDCSITE plans to go back to its “tour” of conducting in-person meetings at various locations around the Section, accommodating members who may live an hour or more outside of the metropolitan Washington, DC and Baltimore, MD areas and may otherwise have challenges attending. With the densely populated and often congested geographic area the Section encompasses, WDCSITE believes this approach helps involve more members in both the meetings, as well as the critical networking that takes place.

WDCSITE is committed to encouraging and supporting its student community. A student scholarship program was started in 2019, spearheaded by Neelima Ghanta (M), who worked with ITE staff to devise a fund that would consistently support this scholarship. Several years ago, the Section began appointing liaisons for Student Chapters to establish a stronger relationship between WDCSITE and its student entities. Liaisons provide more volunteer opportunities for Section members to participate in WDCSITE activities in a more established and committed way; they also help local alumni of these schools reconnect with their alma maters. The liaison works to develop ITE and WDCSITE’s relationship with the academic side of the industry by coordinating with faculty and research and provides a connection for transportation students local to WDCSITE while providing access to professionals, technical speakers, and industry practices.

WDCSITE members and attendees at a Pedestrian Safety Technical Meeting in Baltimore, MD, USA
Student Chapter liaisons are also advancing diversity and inclusion initiatives within WDCSITE, which has active student groups at Historically Black Colleges and Universities (HBCU) like Howard University and Morgan State. The past few years and recent events have shone a brighter spotlight on the need to assess and value diversity across all areas of human experience. Through the liaison effort, the Section aims to provide opportunities for students at these schools (resume workshops, technical meetings, etc.) while exploring the needs expressed by the students and faculty. WDCSITE believes having a variety of backgrounds represented in the Section will facilitate a greater breadth of technical topics, the ability to go into greater depth regarding lesser-known topics, and a more keen awareness of any “blind spots.”

WDCSITE also actively engages local elementary, middle, and high school students to introduce them to the world of transportation and its importance in their lives and to their communities through STEM activities. Several Section volunteers have been invited to promote careers in the field through STEM podcast interviews and panel discussions. Sogand Karbalaieali (M) was on the Fun with Maryland STEM Festival Podcast to talk about what motivated her to pursue a career in transportation. Now with an unofficial STEM committee, WDCSITE is dedicated to regularly planning events for students throughout the year, often in collaboration with volunteers from other associations such as the American Council of Engineering Companies (ACEC), Women’s Transportation Seminar (WTS), and others.

Washington, DC Section of ITE (WDCSITE)

Mid-Colonial District
Areas Represented: Washington, DC; Maryland; Northern Virginia (Arlington, Fairfax, Loudoun, and Prince William Counties)

Members
Approximately 580

Board Members
President – Burak Cesme (M)
Vice President – Adam Greenstein, P.E., PTOE (M)
Secretary-Treasurer – Jon Crisafi (M)
Baltimore Area Director – Elisa Mitchell (M)
DC Area Director – Sogand Karbalaieali (M)
MCDITE Representative and Immediate Past President – David Duarte, P.E., PTOE (M)
Financial Assistant – John Rectanus, P.E., PTOE (M) (Non-voting)

Leadership
Website: Bo Du (M), Alvaro Calle, E.I.T. (M)
Newsletter: Dana Slone, P.E., PTOE (M), Krishna Patnam (M), Eric Tang, P.E., RSP1 (M), Phil Koloski (M)
Social Media: Phil Koloski (M)
Baltimore Programming Committee (Assistant Area Directors): Qiyan Gabriel (M), Puskar Kar, P.E., PTOE (M), Sarah Gary, P.E., PTOE (M), Serese Aranha-Scott, P.E., PTOE (M), Morteza Tadayon; Ellie Shayanfar
DC Programming Committee (Assistant Area Directors): Jiaxin Tong (M), Rakesh Mora, P.E., PTOE (M)
STEM Committee: Adam Greenstein, P.E., PTOE (M), Sogand Karbalaieali (M), Eric Tang, P.E., RSP1 (M)
Public Agency Participation Committee: Vivek Hariharan, P.E., PTOE (M)
Scholarship Committee: Vivek Hariharan, P.E., PTOE (M)
Honors Committee: Vivek Hariharan, P.E., PTOE (M); Emil Wolanin (M), Abi Lerner, P.E. (M), Lewis Grimm, P.E. (F), Alek Pochowski, P.E. (M), Seth Young, P.E., PTOE (M), Dan Goldfarb, P.E., PTP (M)

Did You Know?
• WDCSITE was established in 1943 (first Board identified) and was officially chartered in 1974.
• The Section is lucky to have the headquarters of ITE, the U.S. Department of Transportation, and the National Academies (not to mention many other national/international transportation-related organizations) in its area, giving members easy access to great resources for meetings and members.
• WDCSITE held the “ITE Classic” Horse Race at Pimlico Race Course in May 2015.
• ITE’s very own Executive Director and CEO Jeffrey Paniati was WDCSITE President in 1993.

Communications
Recognizing the need to enhance communication and to complement its various initiatives, WDCSITE created a newsletter committee in 2019, which led to the creation of a monthly newsletter. In addition to Section updates, the publication includes regular updates from ITE Headquarters and other ITE-wide news. WDCSITE also has a presence on Facebook and Twitter to engage with members, informing them about upcoming meetings, events, and other transportation news.

Special Awards Named for Members
Scholarship – Pat Timbrook
Young Professional of the Year – Amy Polk, Selman Altun
Past President – Morris Rothenberg
and Intelligent Transportation Society of Maryland (ITSMD). The COVID-19 pandemic did not hinder this effort, and STEM events moved into virtual formats. Where possible, WDSCITE uses STEM resources available on ITE’s website as guides to plan exciting and engaging activities for collaboration among students, focusing on local perspectives.

WDSCITE has also spearheaded the involvement of public agencies in Section leadership and activities, with the formation of a Public Agency Participation Committee in 2019. Under the leadership of Abraham Lerner, P.E., (M), Seth Young, P.E., PTOE (M), and Vivek Hariharan, P.E., PTOE (M)—all past Section presidents—this committee was formed with a clear set of objectives—to reinvigorate a dwindling public agency participation at local section events and serve as a voice for public agency members to promote their ideas. This committee reviewed the membership data and hand-selected ITE members as “ambassadors” from each public and federal agency within the geographic region of WDSCITE. This committee convenes quarterly via conference calls, discussing ideas to promote the ITE culture within their respective agencies. The “ambassadors” also provide ideas and initiatives such as topic at local meetings, timing of future events, financial incentives, etc., for WDSCITE to consider and execute in its yearly schedule.

WDSCITE is looking forward to gathering in person again with its members but continues to make the most of a virtual format. In 2018, the Section changed its Annual Meeting format from a short business meeting and lunch to a full-day conference, adding several technical sessions. For its November 2020 Annual Meeting, WDSCITE planned a virtual event over two half-days, including fun activities and a virtual happy hour. WDSCITE also plans to hold a scholarship fundraising event later this year.

Virtual swearing-in of the 2021 WDSCITE Board of Directors.

2021 Vision Zero Sandbox Competition

The goal of this challenge is to think beyond the traditional ways of assessing crash data based on historic information and move towards a more proactive approach by leveraging new near-miss data analytics and technology.

Teams are challenged to demonstrate how automated conflict data being collected through innovative technologies can be used to gain new insights into safety problems and the selection of low-cost countermeasures at intersections.

Sponsored by the ITE Consultants Council

There will be separate professional and student categories.

Submission deadline: April 15

For more information: www.ite.org/sandboxcompetition
2020 Developing Trends Report

The Developing Trends Report aims to give insight into the transportation complexities that can guide the profession’s discussions on implementing new solutions and re-evaluating traditional approaches.

This report was possible with foresight from ITE Councils and Standing Committees and the work of the Developing Trends Report Task Force, Dr. Sogand Karbalaieali (M), Tyler Krage, P.E., PTOE (M), and Arif Khan, M.Eng., P.Eng, PMP (M).

The Developing Trends Report represents collective input from ITE Councils and Standing Committees on emerging transportation challenges and solutions. The report covers transportation planning, engineering, management, and operation advancements designed to benefit the industry’s leaders and professionals in the public and private sectors.

The 2021 Developing Trends Report includes 27 one-page trend descriptions. Topics in this edition include:

- Changes in society now and moving forward due to the COVID-19 pandemic
- Evolving areas of innovation, including connected automated vehicles, smart work zones, and crash prevention
- Active transportation challenges and opportunities such as the use of data analytics, links to equity and accessibility, and designing for safety
- Rethinking public assets such as curbsides and public parking spaces

The Developing Trends Report is designed to inspire creativity and motivate agents of change within ITE and across the full spectrum of the transportation industry. Our hope is that this year’s report will create a healthy dialogue within our industry, achieve the goal of sharing state of art and state practice, and leverage ITE’s collaborative spirit. If reading this document inspires you, please reach out to one of our Council and Committee Chairs by visiting our website at www.ite.org/technical-resources/councils.itej

Access the Report

Voice and Value

Sogand Karbalaieali, Ph.D. (M)
Traffic Operations Engineer, ATCS
Herndon, VA, USA

Education
Ph.D., Civil Engineering - Transportation Engineering, Louisiana State University
MS, Civil Engineering - Geotechnics Engineering, Iran University of Science and Technology, Tehran, Iran
BS, Civil Engineering, University of Tabriz, Tabriz, Iran

ITE Awards and Experience
NOCoe E-Profile TSMO Student
ITE Coordinating Council Member
ITE Taskforce Chair, Developing Trends Report
Washington, DC Section of ITE (WDCSITE) DC Director
WDCSITE STEM Event Volunteer

Fun Fact
Sogand is mom to three dogs Nellie, Bambam, and Pebbles. She is a former yoga instructor at the LSU Cultural Center and a runner and cyclist in training.

ITE JOURNAL: What have you learned from working on the ITE Developing Trends Report—how will it be useful to transportation practitioners?

KARBALAIEALI: Working on the report, I learned the value of volunteer contribution. We had great teamwork in a small work platform. Most ITE Councils, Committees, and Subcommittees contributed to the report’s content, and it took considerable effort to make sure no one was left behind. I learned about transportation engineers and planners’ priorities in different fields and their overlapping contexts, such as safety, equity, and big data in ped/bike, and connected vehicles. This report can be useful because it introduces new ideas, and ideas that are currently shaping. The report style is brief and informative; it can offer members projects or research options. Members may become interested in joining a committee or council and being a part of the dialogue themselves.

ITEJ: Your professional work encompasses several areas. How can transportation professionals from various backgrounds work together to create more livable, connected communities?

KARBALAIEALI: Transportation is a broad term, and it’s not enough to be an expert in one field without knowing anything about other subjects. Transportation is entangled with people’s behavior and choices. It’s also about how urban, suburban, and rural lifestyles affect our way of traveling. How can we solve transport problems if we leave equity, environment, and people from different races, genders, ages, and abilities? We can do much with traditional traffic operations and design, so we must utilize technology like connected vehicles to address current challenges in moving people and goods. We need a diverse community of transportation professionals who can look at a problem from different angles and develop a more comprehensive solution rather than widening current roads or adding new highways. We need to step out of our transportation realm, and think out of the box sometimes.

ITEJ: As the upcoming Washington, DC Representative for WDCSITE, what inspired you to take on a leadership role in your Section?

KARBALAIEALI: I am very excited about my new role. This is an opportunity to share knowledge, listen to each other’s ideas, keep up with local projects that we may not know about, and bring people together, even in a Zoom event. In a professional setting, being a woman and a person of color from overseas was not easy for me to show up at professional events. But communication and getting together to share different perspectives is my passion. People like me do not have the most extended arm to raise or the loudest voice to talk. Still, we have some knowledge that everyone can benefit from. That being said, I chose ITE membership as my professional organization, where I did not see many people like me. I wanted to bring my voice and my value to the table. I received great support from Eric Rensel (M), Kris Milster, P.E., PTOE (M), and Adam Greenstein, P.E., PTOE (M) and started to lead and get involved, including with the Developing Trends Report and local STEM events. My ITE membership has allowed me to connect with public and private practitioners that otherwise were inaccessible. I use my new position to give voice to people of color, diverse genders, public servants, innovative private companies, and people at the cross-section of transportation with computer science, environmental justice, climate change, equity, public health, etc. I invite anyone who has something to share with WDCSITE to contact me. We can learn from other cities and even other countries on how to improve things at home.
ITE Virtual Student Leadership Summit

February 19-20, 2021

For the first time, transportation students from 15 universities from around the world are collaborating to organize a one-of-a-kind event featuring sessions on career development, leadership, technology, competitions, and socials—all for students.

An Opening Session will feature a panel on Purposeful Leadership: Becoming a Leader Who Positively Influences Communities, Companies, and the Profession.

Additional sessions include and are not limited to:
- AI and Transportation Technology
- What You Need to Know (Before You Graduate!)
- Leadership: What It Means to You, Why It’s Important to Develop Leadership Skills, and How ITE Helps Develop Leaders
- Incorporating Sustainability in Transportation Infrastructure and Planning
- Equity and Transportation – What Does it Mean and How You Can Affect Equity
- Driving Simulation from Research to Reality

Registration is $10 for student members, $25 for professional members, and $50 for non-members. All registration fees will go towards supporting the ITE Diversity Scholars Program.

For more details and to register, go to www.ite.org/virtualsest.
INDUSTRY NEWS

Jo Ann Hardesty is Portland’s New Transportation Commissioner

An article posted on BikePortland.org discussed Portland’s new Transportation Commissioner and what residents can expect from her term in the position. Jo Ann Hardesty, the 63-year-old former state representative, NAACP president, and Portland’s first Black woman city council member, will lead the Portland Bureau of Transportation. PBOT is a 900-employee organization that manages the streets, a bike and e-scooter share system, regulation of ride-hailing firms Uber and Lyft, our Vision Zero plan, and more. Hardesty’s leadership is expected to focus on seeking “transportation justice.”

TRB Sustainability and Emerging Transportation Technology Conference

Convened by Transportation Research Board, the Sustainability and Emerging Transportation Technology (SETT) Conference will be held June 29–July 1, 2021 at the Arnold and Mabel Beckman Center in Irvine, CA. The conference will address questions around how policy makers, the private sector, and others can work together to support transportation innovations in ways that promote sustainability and benefit all users of the transportation system particularly in terms of public health, equity, and accessibility. Transportation technologies and new approaches to mobility are advancing so rapidly that it can be difficult for policy makers to frame incentives, regulations, and market signals to promote all three pillars of sustainability: equity, the environment, and the economy. The SETT 2021 conference will bring together researchers, practitioners, and policy-makers to discuss and debate the intersection of sustainability and emerging transportation technologies with a focus on solutions. For more information, visit https://trb.secure-platform.com/a/page/Sustainability2021.


The U.S. Department of Transportation (USDOT) held a virtual Pedestrian Safety Summit to discuss pedestrian safety issues and determine initiatives and actions to improve pedestrian safety in the summer of 2020. In conjunction with the summit, two documents were released in late 2020, the USDOT Pedestrian Safety Action Plan and USDOT Summit on Pedestrian Safety Virtual Series: A Summary Report. To read these documents, visit https://highways.dot.gov/pedestrian-safety-summit.

Principles for Universal Curbside Language & Standards Report Available

Cities and towns face a massive hurdle to managing their curb space: the lack of a uniform way to define the curb and its users. Without a universal curb standard, it’s difficult for local governments to coordinate with each other and private entities and assess the effectiveness of their curbside management policies.

Participants in Transportation for America’s Smart Cities Collaborative joined together to create five principles that should inform the development of any universal curbside language and set of standards. These five principles for a national standard will ensure that the public interest is embedded within the standard and language itself, giving cities and towns a shared definition of the curb and its users while empowering them to customize curbside management to best serve the unique needs of their residents. You can read much more in-depth on these principles and the need for a UCLS created by the public sector in the report Principles for Universal Curbside Language & Standards by visiting http://bit.ly/UniversalCurbPrinciples.
Transoft Solutions Promotes Daniel Shihundu to President

Transoft Solutions, developers of productivity-enhancing software and services for the civil, transportation, and aviation industry, is pleased to announce the promotion of Daniel Shihundu to President of the company. In this key role, Mr. Shihundu will take over some of the responsibilities from current President and CEO, Milton Carrasco. These duties include overseeing the company’s revenue-generating operations, developing company strategies and goals, executing mergers and acquisitions, and sustaining the company’s culture. Mr. Carrasco will still retain his position of CEO with Transoft Solutions.

U.S. President Biden Taps Pete Buttigieg for USDOT Secretary

ITE commends U.S. President Joseph Biden for his selection of Pete Buttigieg for Transportation Secretary of the U.S. Department of Transportation. “We are very pleased with the selection of former Mayor Buttigieg for this important position leading the U.S. Department of Transportation (USDOT). His experience as the Mayor of South Bend, IN, USA provides him with an understanding of the critical role that infrastructure investments play in our economy, our climate and our ability to provide safe, equitable, mobility choices,” said Jeffrey F. Paniati, P.E. (F), ITE Executive Director and CEO. “ITE looks forward to continuing our work with USDOT to help meet the needs of all users of the nation’s transportation system.”

NEW PRODUCT

Florida DOT Approves Econolite’s ZincBlue2 Battery Backup System

Econolite recently announced its ZincBlue2 battery backup system (BBS) has been added to the Florida Department of Transportation (FDOT) Approved Products List (APL) under the 685-002-017 certification for Uninterruptable Power Supply (UPS). ZincBlue2 is the next-generation intelligent digital battery-based UPS solution that utilizes an innovative nickel-zinc chemistry. ZincBlue2’s nickel-zinc battery design is an environmentally-conscious alternative to lead-acid battery systems used to energize signalized intersections and IT equipment even when utility power is lost.

There are more than 165 transportation agencies in 40 states and provinces that have now solidified their commitment to increasing safety, economic growth, and environmental sustainability by switching from lead-acid BBS to nickel-zinc-based BBS. ZincBlue2 significantly reduces operational costs, the risk of environmental hazards, and the use of other hazardous materials found in lead-acid batteries and lasts twice as long as traditional lead-based battery backup systems. ZincBlue2 is also half the size and weight of lead-acid batteries, fitting in the unused space of existing cabinets, so there are no additional mounting or external cabinet requirements.

Product reports are based on information and literature provided by the manufacturer/distributor. Publication herein does not constitute endorsement of the product by ITE. If you have a new product announcement you would like considered for publication, please send to Holly Stowell at hstowell@ite.org. When contacting a manufacturer/distributor for more information, please mention that you learned about the product in ITE Journal.
Making the Most of Big Data and Data Analytics

By Shawn M. Turner, P.E. (M)

Big data and data analytics are revolutionizing our society—dramatically changing our home and work lives, and everything in between. We rely on smart devices and websites/apps that know us and our patterns of behavior better than we know ourselves. This detailed knowledge of us is created by collecting lots of data about us and using advanced data analytics to make informed decisions about what to do next (or what to advertise to us).
This same revolution in big data and data analytics is happening in transportation. We know how fast or slow traffic is moving on our commute before we step out the door. We know, to the minute, how soon the bus or train will be coming. We can hail a ride with a few finger gestures on our smartphone, and the driver knows exactly where to pick us up and drop us off without asking us one question. They even know our name and our past experiences with ride hailing. All of this is possible because of big data and data analytics.

ITE Listening Sessions

The ITE International Board of Direction identified big data and data analytics as a critical issue for 2020 and sought input on how to help ITE members harness this data revolution in the transportation profession. In January 2020, ITE planned to hold a series of in-person listening sessions at five ITE District Meetings in the spring and summer of 2020. Of course, the COVID-19 pandemic struck in March, and ITE pivoted to a series of five online discussion sessions.

The five ITE Big Data and Data Analytics Online Discussions were held in April, May, and June, and were limited to 100 registrants to ensure opportunity for involvement and discussions. The 90-minute sessions started with a 20-minute presentation (Figure 1) by ITE member Shawn Turner, P.E. (M) that highlighted examples of big data in transportation and outlined possible issues and challenges. The remaining time—about 60 minutes—was devoted to audience participation in the form of questions, sharing success stories and challenges, and suggestions for how ITE can help its membership.

Despite our initial disappointment of canceling the in-person discussions at ITE District Meetings, we found that the five Online Discussions were just as successful and likely included participants that would not have attended the ITE District Meetings. Participant discussion and interaction was healthy in all five sessions, in all cases using the fully allotted time of 60 minutes. ITE staff orchestrated the online meeting setup. Jason Crawford, P.E. (M) and Eric Rensel (M) served as moderators, directing typed-in questions and calling on selected participants who “raised their virtual hand” to ask questions or provide comments. Also, Radha Swayampakala, P.E., PTOE (F) helped to organize the discussion sessions and prepared the discussion summaries. The most frequently mentioned terms from the five Online Discussions are shown in a word cloud (Figure 2), a common visualization tool for big data.

We Listened…and Heard This

We received great input from the ITE Online Discussions, and there were several recurring themes heard consistently across the five sessions.

- **How should I evaluate the quality and features of commercially available data products and platforms?** ITE members at public agencies and consulting firms are relying more on private data providers for transportation data, and they need consumer advice to make informed decisions about getting quality data. They also want to know more about how data providers process and synthesize raw data sources into a data product or platform.

- **What tools and systems are best to store big data and perform advanced data analytics?** ITE members want to know which tools are best for big data and data analytics in their day-to-day work. Typically, these are new tools (like cloud computing and data science applications) that they have not yet encountered in their transportation career.

- **Where can I get training and professional development?** ITE members want to be prepared for the current and coming waves of big data in transportation. They want to ensure that their data analytics skillsets are relevant and marketable in 2021 and beyond.

- **Where can I learn more about new and emerging big data sources?** ITE members want to know more about who is
collecting what data now and in the future, especially since private companies are increasingly collecting and selling more transportation data.

- **What are the most common uses of big data?** ITE members want to understand how all these new and emerging data sets can be used to make transportation safer and more efficient. And because they are being asked to do more with less, they want to know how to make themselves smarter and more efficient in their jobs.

Here are some of the most frequently asked questions during the Online Discussions:

- What is the value of these data?
- How accurate are the data?
- How do you address the inaccuracies?
- What kind of questions should we ask the vendors to understand the intricacies of their data?
- Where are the latest data?
- What is a methodological way of reviewing these data?
- What kind of sampling do these data carry?
- What are the sources of these data?
- What is the best use of each data set?
- What can be done when we have limited data?
- How do we make sure that the data we are receiving are usable?
- How do we screen the data?
- How do we flag issues in these data?
- What are the limitations of these data sets?
- What storage capacity do we need for these data sets?
- How long do we need to save these data for future reference?
- What are the different tools we can use to analyze these data?
- How do we explain big data and make it defensible in discussions with elected officials?
- Is mobile device data being used for traffic counts?
- We do not want big data to be a black box. What can the data set owners provide us to understand the intricacies of these data? *itej*

---

**Shawn M. Turner (M)** is a senior research engineer at the Texas A&M Transportation Institute, where he has developed, conducted, and managed applied research for 29 years. Shawn is a nationally recognized expert with practical experience in multimodal travel data collection and analysis, performance measures and monitoring, and mobility analysis. He works with the Federal Highway Administration, state, and local agencies to advance the use of best available and high-quality data in planning, performance management, and traffic monitoring. Shawn has been a member of ITE since he started his career in 1992.
Big Data and Data Analytics: Where ITE Intends to Go

By Eric Rensel (M), Gannett Flemming, Chair – ITE Coordinating Council

The ITE Coordinating Council will take the results of the Big Data Analytics Listening Sessions and move the topic forward through appropriate Councils and Committees. If you haven’t been involved in a Council or Committee before visit www.ite.org/technical-resources/councils/ to find the one that fits your passion. Moving into 2021, a Joint Committee on Data will be created to further analyze the results from the listening session and begin to form guidance for practitioners across a variety of subject areas. The first part of the year will involve creating the Committee and appointing a diverse and inclusive membership roster with people from within ITE Councils and Committees and other key partner agencies and associations. The Committee will be charged with developing an action plan and delivering to ITE at the Annual Meeting in Portland.

It is anticipated that the output from the Joint Committee on Data will take the form of familiar ITE products such as informational reports, quick bites, webinars, and meeting sessions. It is also possible that the committee will recommend changes to ITE publications and perhaps develop Recommended Practices. For more information about the formation of the Committee and its progress, be sure to stay tuned to the ITE e-Community and attend a Council meeting at the Joint ITE International and Mountain and Western Districts Annual Meeting and Exhibition.

Fjords are bold. Is your leadership bold?

Fjords boldly intertwine land and water. For some, land represents the power of intellect and water represents the equal power of intuition. Blue Fjord Leaders embody the skilled integration of both.

This is the leadership needed today.

Develop your Blue Fjord Leadership skills now

On demand learning • Instructor led virtual training • Custom programs using the Blue Fjord Leadership System

www.bluefjordleaders.com
Big Data Applications for Managing Roadways

By Jijo K. Mathew, Jairaj C. Desai (S), Rahul Suryakant Sakhare (S), Woosung Kim, Howell Li, and Darcy M. Bullock (M)

The cost of traditional Intelligent Transportation Systems (ITS) sensors for travel time monitoring are on the order of $10,000 per mile. Equipment costs for dense spacing of roadside detection can exceed $100,000 per year. These systems require ongoing maintenance and data processing that result in additional recurring costs. However, newly emerging connected vehicle data can now provide motorists and state departments of transportation (DOTs) with nearly ubiquitous monitoring of their roadways. Developing scalable techniques to use hard braking events and high-resolution trajectory data from connected vehicles can, in many cases, provide higher quality data than traditional fixed ITS sensors at a lower cost.
The State of Connected Vehicle Data – How Big is Big?

During the past decade, there were a variety of probe vehicle data sources receiving widespread deployment, ranging from roadside Bluetooth and Wi-Fi sensors to crowdsourced vehicle telematics based probe data. Currently, it is estimated that one in every 28 vehicles in the United States provide some type of telematics-based connected vehicle data through one of the commercial probe data providers, although this is anticipated to grow significantly, as more than 470 million connected vehicles are expected worldwide by 2025. The current frontier of opportunity is to move from segment-based reporting to individual trajectories reporting at a resolution of 1-3 seconds. Commercial data providers are beginning to enhance trajectory data further by providing event data, such as hard braking and hard acceleration. Figure 1 shows the number of connected vehicle events accessible during August 2020 from 11 U.S. states from one connected vehicle data provider. In total, more than 167 billion anonymized movement data—consisting of a unique trip and data point identifier with GPS position, timestamp, speed, heading, and ignition status—were recorded in August 2020. The penetration rate was observed to range from 10 percent in urban areas to nearly 2 percent on rural interstates. In addition, more than 103 million hard braking events occurred during this period for those same states. On a national level, more than 400 billion connected vehicle events are now available every month. As additional data providers and original equipment manufacturers (OEMs) enter this data space, the volume of this connected vehicle data is expected to dramatically increase.

Figure 1. More than 167 billion connected vehicle records across 11 states, August 2020.

Storage and Data Analytics Platform

With increasing probe penetration rates and additional vehicle attributes in the data, it has become a challenge for agencies to manage the computing infrastructure necessary to support storage and analytics. For example, one month of connected vehicle data in Indiana is over one terabyte in size, consisting of more than 10 billion records. The data must be stored on a platform that enables quick analysis to support interactive dashboard access for agencies managing the roadways. Typically, a relational database management system (RDBMS) is employed for such purposes, such as an SQL Server. Traditional server procurement involves specifying how much storage is required, type of storage, processing power, memory, database software licensing, and backups. Recent advancements allow storage and database management to be done in the cloud.

While there are no upfront fixed costs for cloud-based systems, the monthly pricing depends on how much data is stored, how long data are stored for, and what analytics are performed against the dataset. There are several major cloud data providers available for an agency to choose from. A representative cloud cost for the Indiana connected vehicle data is $20 per month per terabyte to store the data, and $5 to analyze each terabyte. To put it in perspective, running an analysis on a corridor with 100 million GPS points, or about 10 gigabytes, would cost five cents. Depending on the use case and data retention policy, agencies now have several options between cloud platforms and infrastructure maintained on-premise at the agency. In many cases, the data architecture and retention policies will have the most significant impact on cloud computing costs.

Near Term Opportunities – Interstate Queues and Associated Back of Queue Crashes

One of the primary objectives of the traffic incident management performance measurement program developed by the Federal Highway Administration is to reduce the number of secondary crashes. Past studies have shown that crash rates during congested periods can increase by a factor of 24 compared to uncongested periods on interstates. Hard braking events, which are “near-misses” or “close calls” during these periods, are potential predictors of future crash events. Although only a few studies have analyzed hard braking events and crash frequencies, one recent study found that there was approximately one crash per mile for every 147 hard braking events within the vicinity of an interstate work zone.

Indiana has developed several web-based connected vehicle dashboards to monitor interstate conditions in real-time, especially during construction, interstate crashes, traffic detours, and winter operations. Figure 2a is adapted from a similar dashboard Indiana uses to monitor statewide interstate queues and hard braking events. On a typical day, Indiana has approximately 307 mile-hours (494 kilometer-hours) of queueing on interstates (12 percent of the state’s interstate roadway system) and 220,000 hard braking events. A hard braking event is defined as a deceleration of more than 8.76 feet/s² (or 2.67 meters/s² as defined by OEM), as measured by an accelerometer on-board the connected vehicle.
Figure 2a illustrates a case study showing a time-space diagram of individual trajectories color coded by speed overlaid with hard braking events (red dots) for I-70 in the westbound direction between mile markers 40 and 60 on September 24, 2020. Approximately 536,000 data points from nearly 2,200 connected vehicles were linear referenced to this route after performing geospatial analysis on more than 365 million records. The pink hues signify data points with speeds below 15 miles per hour (24 kilometers per hour). Crash data obtained from the state repository shows a primary crash (callout P) and a secondary back-of-queue crash (callout S) that occurred around 15:00 hours.

Figure 2b illustrates the detailed assessment of the queuing during the event that occurred between 15:00 and 18:00 hours. The two crashes resulted in a 12-mile (19.3 km) long queue (callout ii) that impacted traffic for nearly 2.5 hours (callout i). The interstate was also closed for more than 30 minutes (callout iii) after the secondary crash. Several hard braking events (red dots) occurring at the boundary between the congested and uncongested regime indicate the critical areas where drivers decelerate to avoid back-of-queue or rear-end collisions. This hard braking information and locations will be helpful for agencies to strategically provide advance warnings and other queue mitigation solutions to improve the situational awareness of nearby motorists.

Another feature of this enhanced probe data is the additional information that agencies can gather from this dataset. Callout iv shows a vehicle turning off ignition when the interstate was closed, and later resuming the trip after the interstate was opened to traffic. Such rare events on interstates are potential indicators of traffic shutdowns. Callouts D1 to D9 shows the diverting trips that avoid the queues by taking Exit 51 before returning to the interstate at Exit 41. This information helps agencies understand the impact of diversion routes.

Independent Validation of Queues Identified by Connected Vehicle Data
Indiana has approximately 350 ITS cameras in its statewide surveillance system. These cameras can be used to validate and illustrate the value of connected vehicle data. The location of the slowdowns depicted in the connected vehicle heat map (Figure 2) can be associated with fixed ITS cameras and integrated into a statewide surveillance tool. Callouts C1 to C4 on Figure 2b corresponds to the images captured by the ITS camera (Figure 3) near MM 55. The

It’s Time to Renew!
Don’t Lose Your Access to a World of Ideas, People, and Resources

Find Out What Works
ITE is your source for a wide range of technical tools and solutions to the challenges you face every day.

Build Your Network
When you join ITE, you gain opportunities to connect locally, regionally, and internationally, virtually, and in-person.

Stay Ahead of Industry Trends
ITE’s suite of communication channels not only keeps you in the know, but helps you sort out fact from fiction.

Join more than 16,000 transportation professionals who are passionate about improving the communities they live and work in. Gain access to the critical ideas, people, and resources you need to get your job done. Renew your membership today!

Go to www.ite.org to renew.
Figure 2. September 24, 2020 Traffic heatmap for Indiana I-70 overlaid with trajectories colored by speed, crash events, and hard braking events:
a) 24 hour view, b) detailed view between 15:00 and 18:00.
back-of-queue (Figure 3, callout i) and vehicle braking at back-of-queues around 16:53 (Figure 3, callout ii) are clearly evident. Figure 3b shows the long queues formed within 3 minutes of Figure 3a. The queue dissipation begins around 17:08 (Figure 3c) and clears around 17:11 (Figure 3d). The images captured by the cameras independently validate the queues identified by the connected vehicle data.

Scaling Connected Vehicle Data Statewide to Provide Actionable Information for Decision Makers

Figure 2 illustrates connected vehicle data attributes now available and Figure 3 validates the quality of this data. However, with more than 200,000 hard braking events occurring on Indiana interstates every day, it is important to develop scalable use cases for decision makers to identify emerging areas of interest for further investigation. Figure 4a illustrates the scalability of hard braking data with a statewide map that identifies locations with the largest weekly change in hard braking events in Indiana.

This statewide ranking of changes in one-mile interstate segments was established by analyzing more than 2,600 segments of interstate roadway in Indiana and comparing percentage change in weekly hard braking events between the weeks of September 7-13 and September 14-20, 2020. Figure 4a shows a map of the top five locations with the highest percentage increase. Figure 4b shows how an isolated crash incident on Friday, September 18 (near MM 35 on I-465 outer loop) resulted in an increase of hard braking events compared to the previous week. In contrast, Figure 4c illustrates how construction activity (near MM 14 on I-94 eastbound) resulted in recurring increase of daily hard braking events during the entire week of 9/14-9/20 compared to the previous week.

Further details regarding the day-by-day frequency of hard braking events on approximately 1,700 directional miles (2,736 km) of Indiana interstates is shown in tabular, graphic, and video format. To demonstrate the national scalability of this, a similar data set for approximately 1,000 directional miles (1,609 km) of I-35 in Texas is shown in a paper by some of the authors.

Summary

Dashboards using segment data have been widely used in several states. However, the utilization of enhanced trajectory-based data is still in its early stages. More than 400 billion enhanced probe vehicle records are now available per month that state and federal governments can integrate into their monitoring,
management, and infrastructure investment decisions. The techniques presented in this research for visualizing interstate queueing, hard braking, and crashes can be scaled to provide these types of visualizations nationally (Figure 2 and Figure 4). Construction work zones are perhaps the nearest term opportunity for agencies to use connected vehicle data because they provide high-precision data on sections of their networks that are under construction, but with little or no traditional ITS infrastructure.

Agencies now have different options for storing and analyzing probe data sets of this magnitude using cloud platforms. As an alternative architecture, traditional on-premises platforms can be used for the majority of the day-to-day user systems, long-term backups and archives, and application code, while some of the larger datasets for active analysis can be hosted in the cloud.

Future research will be directed towards understanding the impact of back-of-queue warning signs and other mitigation strategies proactively deployed by agencies using this data to reduce safety hazards on roadways. itej

Acknowledgements

Data used in this study were provided by Wejo, Ltd. Google BigQuery was used for the cloud database analysis and storage. The contents of this paper reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein, and do not necessarily reflect the official views or policies of the sponsoring organizations. These contents do not constitute a standard, specification, or regulation.

References


Video Visualization

To illustrate the nationwide scalability of these techniques, the authors produced two YouTube videos that show the daily variation in hard braking events on:
- Indiana interstates: https://youtu.be/lqxNNbI4Sv25
- I-35, Texas: https://youtu.be/Yr9f26XfAU26


Jijo K. Mathew is the senior transportation research engineer with the Joint Transportation Research Program at Purdue University. He specializes in developing system performance measures to understand operational objectives and guide investment decisions. Mathew received his Ph.D. in Civil Engineering from Purdue University and a master’s from the Indian Institute of Technology, Madras.

Jairaj C. Desai (S) is a graduate research assistant with the Joint Transportation Research Program at Purdue University. Desai holds a master of science in Aeronautics and Astronautics Engineering from Purdue University and a bachelor of technology in Aerospace Engineering from Indian Institute of Technology, Kharagpur.

Rahul Suryakant Sakhare (S) is a graduate research assistant with the Joint Transportation Research Program at Purdue University. Sakhare holds a master of technology and bachelor of technology in Civil Engineering with specialization in Transportation Engineering from Indian Institute of Technology Madras.

Woosung Kim is a software engineer with the Joint Transportation Research Program at Purdue University. He specializes in developing software applications for transportation research. Kim holds a bachelor’s degree in Computer Science from Purdue University.

Howell Li is the senior software engineer at the Joint Transportation Research Program at Purdue University. He has more than 13 years of professional experience in software systems development and more than seven years in transportation systems research. Li holds a master of science from Purdue University College of Engineering and a bachelor of arts from New York University.

Darcy M. Bullock, P.E. (M) is the Lyles Family Professor of Civil Engineering at Purdue University and serves as the director of the Joint Transportation Research Program at Purdue University. Bullock is a registered Professional Engineer in Indiana and has 30 years of experience in the industry working with transportation agencies and private sector partners.

To learn how we can work together to improve safety for vulnerable road users in your city or state, visit the link below.

iteris.com/VRUsafety
Courses Offered as Part of ITE’s Partnership with the Consortium for Innovative Transportation Education at the University of Maryland
ITE members receive a 20% discount by registering through ITE.

Traffic Signal Operations
February 4 – March 14
This course provides students with an understanding of both the theory and practice of traffic signal timing and its impact on traffic operations.
Instructor: Kevin Lee, Kittelson and Associates

Program Planning for TSMO
February 11 – March 28
In this course, you will define why TSMO is important to your organization, describe the key elements of TSMO program planning, and identify TSMO planning activities that help to develop and sustain the TSMO mission for your agency.
Instructor: Lisa Burgess, Kimley-Horn and Associates

Spring Course
Transportation Impact Analysis (TIA) Training Program
March 1 – May 3
Registration is now open. Register at http://bit.ly/RegisterTIA
The Transportation Impact Analysis (TIA) Training Program is a new certificate-based, blended learning program that provides students with a comprehensive coverage of the technical elements of the TIA preparation and review.

Road Safety Fundamentals Webinar Series
Developed by the ITE Safety Council
This 10-part webinar series highlights various aspects of road safety as part of ITE’s continued focus on Vision Zero and the goal to reduce and eventually eliminate fatalities.

- Safety for All Road Users (Recording available on-demand)
- Partnerships that Create a Lasting Safety Culture (Recording available on-demand)
- Safety Analysis Tools (Recording available on-demand)
- Basic Statistics and Predictive Safety (Recording available on-demand)
- ITS, TSMO, and Safety in Operations (Recording available on-demand)
- Safety Considerations in Transportation Planning
- Road Geometry and Roadside Safety
- Systemic Safety and Network Screening
- Human Factors
- Road Safety Audits

Upcoming Live Webinars

Road Safety Fundamentals: Human Factors
February 2
Developed by the ITE Safety Council

Sustainable Transportation: Advanced Vehicle Technologies, Electrification, and Next-Generation Mobility
February 4
Developed by the ITE Sustainability Standing Committee

How to Successfully Teach During a Pandemic: Contrasts between Audiences of College Students and Working Professionals
February 9
Developed by the ITE Education Council

COVID Effects on Transportation
February 10
Developed by the ITE Traffic Engineering Council

Use of Data in Smart Communities for COVID-19 Response and Recovery
February 16
Developed by the ITE Smart Communities Standing Committee

Vulnerable Road User Safety at Signalized Intersections
February 23
Developed by the Vision Zero Standing Committee

Road Safety Fundamentals Webinar: Road Geometry
February 25
Developed by the ITE Safety Council
Impact of Navigation Applications on Traffic Operations

By Scott Poska, P.E., PTOE, RSP1 (F), Andrew Kaplan, P.E. (M), and Jennifer Alford, P.E., PTOE (M)
It is no surprise that the popularity of mapping and navigation smartphone applications has exploded in recent years. Travelers trust and rely on these applications for making routing choices before and even during a trip. Currently, mapping applications are providing traveler information with little collaboration with transportation professionals or the data related to the systems they manage commonly found in Transportation Management Centers (TMCs). Transportation professionals, specifically traffic operations engineers, need to be aware of the functionality of these applications and how to work with these companies to communicate the latest system status. Cooperating with application developers to provide accurate information can have a real-life impact on safety and operational efficiency for our roadway systems.

**Navigation Application Statistics**
According to Statista, 81 percent of adults in the United States own at least one smartphone device. This number has been trending up each year across all income levels and demographics. Additionally, information consumption has been significantly shifting towards mobile applications. Between 2013 and 2016, there was a 111 percent increase in minutes spent on mobile applications, while desktop time had a nominal increase of 3 percent. Agency-maintained traveler information systems, such as 511, are accessed by travelers, but not nearly to the extent that smartphone apps are accessed and used.

*The Manifest*, a business news and how-to website that compiles and analyzes practical business wisdom, conducted a survey of 500 smartphone owners in 2018 to understand drivers’ reliance on navigation applications. Their findings showed that 77 percent of smartphone owners regularly use navigation apps with 87 percent of those using them primarily for driving directions. The survey asked about the user’s route choice selection process—more than one-third (36 percent) of smartphone owners use navigation apps prior to leaving their location; 34 percent use them en route, and 30 percent use them both prior to leaving and en route equally.

**The Problem**
There is a general lack of partnership, communication, and data exchange between roadway authorities and navigation application developers. Navigation applications vary widely in how they can be contacted, if at all. Most have a general feedback/map error reporting process, which is used by the public. Waze is unique in that it has a dedicated program to connect roadway authorities with its platform. Apple Maps offers a limited number of roadway authorities a direct contact email address. The overarching problem is the lack of knowledge about communication methods by roadway authorities.

Navigation applications acquire real-time roadway information from several sources, including users of their applications (crowd-sourced data). Some applications, such as Waze, rely on users to submit roadway information data from their trip for use by other users. Additionally, some applications “scrape” published information from roadway authorities, such as 511, Twitter, or websites. This method results in translation errors from time to time. For example, in 2018, a major mapping application reported the closure of a vital bridge in the northeastern United States based on outdated closure information found on an adjacent local municipality website.

While the quality of data used by navigation apps has improved over the years, significant inaccuracies occur due to changes to the system. For example, roadway authorities may permanently modify the operations of their system with changes to roadway capacity, intersection control, posted speeds, turn restrictions, and temporary activities such as construction, special events, and emergency response. During these periods of inaccuracy, drivers following application routing have been observed to behave erratically, unsafely, and otherwise in a condition of stress and confusion, which has led to documented crash problems. For example, a major mapping application directed drivers to a prohibited cross-over weave near the George Washington Bridge, NY/NJ, USA resulting in crashes directly attributed to the directions. Following the change in routing, the location observed a statistically significant crash decrease.
As transportation professionals, we view the transportation system in terms of roadway classifications and design capacity. Navigation applications view the system in terms of the path of least resistance—in other words, looking at overall travel time, and do not explicitly take roadway classification into account when providing routing directions to users. As a result, navigation algorithms frequently route users through neighborhoods and down local streets with excess capacity that were not designed or intended to handle high traffic volumes. This leads to local community complaints (e.g. Fremont, CA, USA and Leonia, NJ, USA) about safety and congestion and the need for additional traffic calming measures.4, 5

Navigation Applications Overview
The 2018 Manifest survey found that an overwhelming majority of navigation application users use Google Maps (67 percent), followed by Waze (12 percent), Apple Maps (11 percent), and MapQuest (8 percent).3 The following sections provide an overview of the functionality of the three leading navigation applications and Figure 1 provides a comparison summary.

Project Overview
ITE’s Traffic Engineering Council (TENC) identified the impact navigation applications have on local roadway systems as an emerging issue in 2018. The TENC Mapping/Navigation Application (also referred to as “Route Guidance”) project team seeks to understand and strengthen the communications and the exchange of information between agencies and navigation applications by educating ITE members on how navigation applications work, determining how to best communicate current system restrictions, and providing real-time traveler information to mapping/navigation partners in order to influence routing to improve safety and operational efficiency for the transportation systems they manage.

Project Team
Scott Poska (Chair)  Jennifer Alford  Robert Macioce
Andrew Kaplan  John Hourdos  Ken Knudson
Chuck Huffine  Norman Baculinao  Yang Tao
Farukh Ijaz  Aaron Johnson  Alyssa May
Matthew Paugh

Figure 1. Summary of Functionality of Popular Navigation Applications.

*TNC = Transportation Network Companies

w w w. i t e . o r g  F e b r u a r y  2 0 2 1  3 9
**Google Maps.** Google Maps is available on all computing and mobile platforms. It provides trip routing for a variety of user specified modes including vehicular, transit, pedestrian/walking, biking, and transportation network companies (TNCs). Contacting Google Maps is limited to a generic map feedback form, but responses tend to come from individual staff within the Google Maps team. Google Maps pushes out underlying base map updates every 1-2 weeks. Temporary event updates are pushed out within 48-72 hours.

**Waze.** Waze is available on all computing and mobile platforms, but is limited to providing trip routing only for vehicles. Contacting Waze is the cornerstone of the success of the platform. Any Waze user is able to provide feedback on a variety of roadway events, which in turn are shared with all Waze users. Roadway authorities have the ability to enter into a data sharing agreement with Waze through the Waze for Cities Program (WFC). Roadway authorities can share the current status of their transportation systems. Waze can provide anonymous user data. Waze relies heavily on volunteer mapping editors and regional managers. These volunteers are power users of Waze and have the ability to create base-mapping and event updates in the application. The regional managers can be contacted for making specific mapping updates. The updates the editors and managers make to the base map are pushed to users on a daily basis. Temporary events and planned activities are available to users between 3-48 hours after they are entered in the Waze system.

**Apple Maps.** Apple Maps is only available on iOS and Mac OS platforms. It provides trip routing for several user-specified modes including vehicular, transit, pedestrian/walking, and transportation network companies (TNCs). Contact with Apple Maps is available by a generic map feedback form, but responses tend to come from individual staff within the Apple Maps team. Public agencies have the ability to contact Apple Maps via a special email address. Apple Maps pushes underlying base map updates every 2-3 weeks. Temporary event updates are pushed out within 48-72 hours.

**Navigation Application Data Needs**
A core function of navigation applications is the ability to provide the most efficient routing for users, based on the latest roadway data. This data is critical to ensuring that users receive accurate and timely information.

### Case Study

**Minneapolis, MN, USA**

South 6th Street serves as the main artery out of downtown Minneapolis for traffic destined to the east as it terminates into an on-ramp to eastbound I-94. During the events leading up to Super Bowl 52, South 6th Street was closed in front of US Bank Stadium. A signed detour was enacted for motorists to take South 8th Street east to 13th Avenue to backtrack to South 6th Street. This detour required important temporary intersection geometric and signal phasing modifications at South 7th Street and 13th Avenue to allow the northbound through movement. The signed detour included two portable variable message signs (VMS), as well as several in-place VMS signs in downtown to assist with wayfinding.

After receiving numerous complaints from confused motorists encountering a full closure of 11th Avenue before 6th Street, city traffic operations staff realized that mapping/nav apps were not reflecting the official detour and geometric limitations of the 7th Street/13th Avenue intersection, as shown in Figure 2. After a call for help from the ITE community, the city was able to get in contact with Waze, Google Maps, Apple Maps, and INRIX to inform them of the correct detour and inform them of the temporary modification at 7th Street/13th Avenue intersection, which would require a base map adjustment.

Waze pushed an update out the next day, as shown in Figure 3. Google Maps, Apple Maps, and INRIX stated it would be in place in 1-2 weeks, which would be after 6th Street was scheduled to reopen.

![Figure 2. Incorrect South 6th Street Detour in Apple Maps and Google Maps.](image)

![Figure 3. Correct South 6th Street Detour in Waze.](image)
conditions. When an operations-related event or activity occurs, whether it is permanent, temporary, or something scheduled in the future, navigation applications can apply roadway network changes to provide the optimal routing. The applications typically need the following when putting an event into their systems:

- **System modification activity type**
  - Permanent. Typically takes effect immediately.
  - Temporary. Typically takes effect immediately for a short duration. Examples include emergency response activity (police, fire, etc.) and maintenance activity (water main break, temporary lane closure, etc.)
  - Future. Typically planned in advance and takes effect at a set date/time. Examples include construction (roadway closure, roadway lane restrictions, detour, etc.) and special events (parades, block parties, etc.)

- **Location/segment.** Need location to the nearest 50 feet and specifics on what movements are allowed and not allowed. For example, a closure between intersections is typical, but local access is permitted a short distance on a closed roadway.

- **Direction of travel and intersection movements.** What direction of travel does the activity impact? What specific movements at an intersection are impacted?

- **Start date/time.** Most system modifications are applied immediately, but future scheduled activities can be programmed to take effect at a specified time.

- **End date/time.** System modifications that are not permanent need an end date and time to return to baseline conditions. Some modifications have the ability to automatically end if crowdsourced data indicates traffic is flowing normally.

- **Duration.** Is the system modification continuous or is it recurring on a specific schedule?

### Recommendations for ITE

As a leading professional organization for transportation professionals, ITE is well positioned to create programs, resources, and data standards to fill the identified gaps highlighted in this article. Currently the tech community is aggressively advancing traveler information largely without the collaboration of transportation professionals, nor the authoritative data sets of roadway operators and Traffic Management Centers. Through increased education, cross-industry dialogues and collaborations, and development of data standards, public investments in accurate traveler information data can better serve the public.

Our industry invests significant resources in quality, real-time data through Traffic Management Centers and ITS; however, we are not getting that data into the hands of our drivers who choose to use their smartphone apps for directions. Public traveler information systems will never compete with these phone apps that integrate many non-transportation elements into a seamless user experience (Yelp/Trip Advisor, Grubhub, Postmates, Uber/Lyft, etc).

### Case Study

**Westerville, OH, USA**

It’s not every day that an event of global significance arrives at your doorstep. In October 2019, Otterbein University served as site host for the CNN/New York Times Democratic Presidential Debate. As a suburb to Columbus, OH, Westerville is home to roughly 40,000 people. The university is located near Historic Uptown Westerville and the prospect of several thousand visitors was going to be a challenge. As a result, it was important to get ahead of security issues and prepare residents for the potential inconveniences of such an influx.

In advance of the event, city staff used the Google Maps traffic layer to screen capture existing traffic data at 15 minute intervals. This was used to compare against live traffic information on the day of the event. If noticeable delays were experienced, staff was prepared to adjust signal timing/phasing to clear the queue.

Early on it was determined that those attending the debate would need to park elsewhere and be bussed in. Road closures were needed to provide safe locations for protesters and demonstrators to gather. These were communicated to the public by use of Social Media, the city’s website, and e-newsletter. During the event, Waze users were able to see closures and other road updates.

![Figure 4. Democratic Presidential Debate.](image-url)
1. Educate. As outside influences, such as navigation applications, greatly impact transportation systems we operate and maintain, ITE members need to be prepared and educated about them. The majority of ITE members do not know how the applications work, the impact they can have on mode choice and routing within the transportation system, or how they can be contacted. Therefore, ITE can be a resource to members to learn the basics on how the applications work and how to best engage them.

2. Collaborate Across Industries. Roadway operations and safety is a topic of interest, but not well understood by technologists. Likewise, big data, user experience and integration beyond journey is not well understood by transportation professionals. For example, other search functions exist in Google Maps, such as finding a new restaurant to try. ITE can provide a forum for dialogue between application companies and roadway authorities to meet shared goals. ITE can bring professionals of both groups together through events, dialogues and collaborations. Further, ITE is adept at communicating this knowledge to our broad membership through existing Institute technical knowledge transfer programs.

3. Develop Data Standards. No single public agency has the size and influence to develop a data standard that the global navigation applications will build a connection to. Likewise, few public agencies will develop a data feed to the proprietary specifications of only one navigation application. However, all parties desire guidance to unlock a seamless data exchange. The solution to this gridlock is for a generally accepted data standard to develop. ITE is uniquely situated to develop such a standard, coordinate and pilot deployment with public agencies of varying sizes (from cities to states to authorities), has technical leadership, respected authority through other technical publications in transportation, and is able to represent the industry at scale with navigation applications.

As an independent industry organization of diverse transportation professionals, ITE is uniquely positioned to become a leader in this space—connecting transportation professionals and technology developers—to truly redefine the future of traveler information; and by virtue thereof - the operations, safety and quality experiences of the public.

References

Parking Requirements for Limited-Service Hotels

By John W. Dorsett, AICP
An empirical study of five limited-service hotels (“hotels”) located in South Florida, USA was performed to measure actual parking demand. This study is based on 35 total field-data-collection observations, seven different observations for each hotel, one for each day of the week, all performed at or near the 1 a.m. peak hour of occupancy for hotel guest rooms (all times are Eastern Standard Time). Following is a summary of key findings and conclusions:

- Based on Total Number of Hotel Guest Rooms (Occupied Rooms Plus Vacant Rooms):
  - The 35 field data observations range from a low of 0.05 to a high of 0.76 parked cars per hotel guest room.
  - The 50th percentile (median) and mean observations are 0.39 and 0.38 parked cars per hotel guest room, respectively.
  - The 85th percentile observation, the industry standard for informing parking supply recommendations for hotels, is 0.58 parked cars per guest room. The 95th percentile observation, which exceeds the industry standard for hotel parking supply recommendations, is 0.67 parked cars per guest room.
- The hotel room occupancies averaged 84 percent for 27 studies (5 hotels x 7 days, less 8 occupancies that hotel operators were unwilling to provide), exceeding the U.S. national average of 66.2 percent occupancy.¹
- Based on Number of Occupied Hotel Guest Rooms:
  - The 27 field data observations range from a low of 0.09 to a high of 1.05 parked cars per occupied hotel guest room.
  - The 50th percentile (median) and mean observations are 0.45 and 0.51 parked cars per occupied hotel guest room, respectively.
  - The 85th percentile observation, the industry standard for informing parking supply recommendations for hotels, is 0.70 parked cars per occupied hotel guest room. The 95th percentile observation, which exceeds the industry standard for hotel parking supply recommendations, is 0.88 parked cars per occupied hotel guest room.
- Many communities require one parking space for every built hotel guest room. This study demonstrates that for some locations, this standard could be excessive. Therefore, communities are encouraged to consider relaxing the standard, to acknowledge that ride-hailing companies, such as Uber and Lyft, have decreased hotel parking demand.

**Study Purpose**

Hotel development continues in response to our increasingly mobile society and the need for temporary lodging associated with business and pleasure travel. One challenge for planners is to properly determine limited-service hotel parking needs in the absence of significant data and to consider the impacts of ride-app services such as Uber and Lyft. In response to this challenge, Walker Consultants (Walker) conducted a study documenting the parking requirements of limited-service hotels in a specific geographic market. A major component of this study includes new primary research.

This study is important to planners and developers of limited-service hotels because prior to this study, there was limited published data regarding parking requirements for this land use type. Many area and U.S. municipalities commonly require one parking space for each hotel guest room per their local zoning ordinance—in many cases, this requirement is excessive.

The following are the objectives of this research project:

- To identify and reference industry standards for limited-service hotel parking requirements;
- To create a database of limited-service hotel peak hour parking generation ratios that is based on the number of parking spaces needed per hotel guest room, the variable most commonly referenced by municipal codes; and
- To summarize findings by mean, median, and 85th percentile values.

Meeting these objectives provides information useful to planners in right-sizing limited-service hotel parking capacity.

**TNC Impacts on Hotel Parking Demand**

Transportation network companies (TNCs), sometimes referred to as ride-apps or ride-hailing companies like Uber and Lyft, have and are continuing to change peoples’ transportation habits and are materially reducing parking demand for some land uses including hotels, restaurants, event centers, and airports.
For business travelers, including those requiring hotel guest rooms, depending on location, TNCs are becoming or have become a preferred ground transportation option in lieu of taxis and rental cars, thus reducing hotel parking demand. As a consequence of TNCs, car rental companies such as Hertz and Avis have experienced a reduction in their revenues over the last several years.¹

Travel and expense management service provider Certify found that of the three ground transportation segments for business expense reimbursement—ride-hailing, rental cars, and taxis—the share of Uber and Lyft combined, reached 71 percent of the ground transportation share in Q1 2018.³

Professional experience, which includes multiple conversations with hotel parking operators and published reports, confirms that hotel parking demand has decreased as a result of increased usage of TNCs.⁴

### Types of Hotels

There are reportedly 55,900+ hotel properties in the United States, representing more than 5.3 million hotel guest rooms.⁵ Not all hotels are created equal. There are many different kinds and types of hotels, and the term “hotel” really does not accurately depict the scope, breadth, or depth of activities that take place. The following is an attempt at classifying various types of hotels:⁶

- **Size (number of rooms)** – under 50, 50 up to 150, 150 to 299, 300 to 600, and more than 600 rooms;
- **Location** – airport, casino, city center, suburban, and resort;
- **Level of service** – economy/limited, mid-level, and luxury service;
- **Market and function** – airport, all-inclusive, bed and breakfast, business, boutique, casino, conference center, convention center, extended-stay, leisure, resort, suite, and timeshare and condominium;
- **Ownership and affiliation** – chain with a brand affiliation and independent;
- **Amenities** – accessibility, airport, beach, casino, city center, childcare, fitness club, golf, pool, spa, tennis, and weddings;
- **Industry standards** – AAA Diamond Rating, Trip Advisor Traveler’s Choice, etc.; and
- **Brand standards** – Aloft, Element, Four Points by Sheraton, Le Meridien, Sheraton, St. Regis.

### Methodology

This study focuses on limited-service hotels ranging in size from 151 to 233 hotel guest rooms in a suburban location in northern Miami-Dade and southern Broward Counties, Florida, about 13 miles (21 kilometers [km]) south of the Fort Lauderdale-Hollywood International Airport and 19 miles (30.5 km) northeast of Miami International Airport. Additionally, the closest Tri-Rail Station is the Golden Glades Station (5.6 miles [9 km] or 12 minutes). Properties were studied in this geographic area and hotel type in response to a developer’s proposal to build a similar property in this area.

To complete our primary research, we performed the following steps:

- Researched and summarized industry-standard base ratios for hotel parking generation
- Researched the following variables for each hotel:
  - Freestanding location dedicated exclusively to hotel use and very unlikely to experience parking-related encroachments from adjacent land uses and very unlikely that a portion of the hotel’s parking needs were being met off site
  - City, state, and zip code
  - Number of hotel guest rooms
  - Parking space supply
- Counted the number of parked vehicles during the typical peak time of a weekday
- Determined the number of vehicles counted at typical peak hour of parking occupancy
- Summarized, by occupied spaces per hotel guest room, the mean, median, and 85th percentile
- Developed recommendation regarding the number of spaces to be provided by limited-service hotels for the subject location

Internet searches were conducted to identify freestanding limited-service hotels for study. For purposes of this study, a limited-service hotel is one that is likely a two- or three-star hotel offering very little in the way of personal services. For example, there would be no doorman, bellhops, or concierge; typically, as staffing is limited. The limited-service hotels studied have little to no meeting room space or sit-down, full-service restaurants that would attract outside diners, and these are not located on golf courses or the beach. Food service provided by the limited-service hotels is limited to a small food pantry that offers items for sale on a retail basis, complimentary breakfast for hotel guests, and perhaps a limited-menu, order-at-the-counter restaurant.

Note that the fifth edition of ITE’s *Parking Generation Manual* includes Hotel Land Use Category (LUC) 310 and Business Hotel LUC 312. The properties surveyed for this study do not fall within LUC 310 because of the limited service nature of the properties; no significant convention center or meeting space is included at the properties surveyed for this study, nor is there a full-service, sit-down restaurant. Additionally, unlike the surveyed hotels, LUC 312 Business Hotels includes some hotels with full-service, sit-down restaurants. Therefore, ITE may want to consider creating a new category of lodging for a limited-service hotel that provide very little to no meeting room space or sit-down, full-service restaurants;
without these amenities, a hotel property typically generates parking demand that is limited to hotel guest room occupants and a few hotel employees, and excludes parking demand associated with those accessing meeting rooms and restaurant space without lodging at the hotel.

Secondary Research
The following is a summary of several published sources that were reviewed for purposes of documenting hotel parking requirements within the parking consulting and transportation planning professions:

- The third edition of *Shared Parking*, a joint publication of the International Council of Shopping Centers, the National Parking Association, and the Urban Land Institute, presents a base parking generation rate of 1.15 parking spaces per hotel guest room and this ratio is separated into two components, 1.0 spaces per hotel guest room for guest parking and 0.15 spaces per hotel guest room for hotel employee parking. These base ratios apply to the hotel guest room component for all hotel types including business, leisure, and convention center hotels, irrespective of location. These base rates are then adjusted downward to account for month of year, time of day, non-captive, and driving ratio adjustments.

- The fifth edition of the ITE *Parking Generation Manual* documents the following parking generation rates for hotels and business hotels:

<table>
<thead>
<tr>
<th>Hotel Type</th>
<th>ITE Land Use Code</th>
<th>Hotel Business Hotel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel Type</td>
<td>No. of Studies</td>
<td>Avg. No. of Rooms</td>
</tr>
<tr>
<td>ITE Land Use Code</td>
<td>310</td>
<td>312</td>
</tr>
<tr>
<td>Peak Period (EST)</td>
<td>11 p.m. – 8 a.m.</td>
<td>10 p.m. – 7 a.m.</td>
</tr>
<tr>
<td>No. of Studies</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>Avg. No. of Rooms</td>
<td>321</td>
<td>125</td>
</tr>
<tr>
<td>No. of Parked Cars/Guest Room</td>
<td>Average Rate 0.74</td>
<td>0.72</td>
</tr>
<tr>
<td>Range</td>
<td>0.43-1.47</td>
<td>0.55-0.85</td>
</tr>
<tr>
<td>85th Percentile</td>
<td>0.99</td>
<td>0.83</td>
</tr>
</tbody>
</table>

These industry standards can be assumed to inform the one space per hotel guest room parking requirement that is so common with many municipal zoning ordinances.

ITE Transportation Transforms Communities Video Challenge

Enter Now! Submission Portal Closes May 1, 2021

ITE is seeking short-cut videos (two-minutes max) celebrating the theme: Transportation Transforms Communities. Work with a team (one member of a team must be an ITE member) or on your own to get creative and get people excited about the transportation profession!

The challenge is to create an original video that

- **Showcases the many exciting facets of transportation; and**
- **Highlights ways in which transportation positively affects our communities.**

ITE members will vote on submissions during May 2021.

The winning video will be shown during the Opening Session at the Joint ITE International and Mountain and Western Districts Annual Meeting and Exhibition in July 2021. Recognition will also be provided to the 2nd and 3rd place videos.

The submission portal opens February 1, 2021, and entries must be received by May 1, 2021.
Field Data Collection Results

To present an empirical case for an opportunity of less than one parking space per hotel guest room, parking-space occupancy data was collected at five existing limited-service hotel properties in Aventura (four hotels) and Hallandale Beach (one hotel) to ascertain parking occupancies and parking demand ratios. Properties were selected based on the experience of the consulting team with an aim to select properties that did not share parking with adjacent land uses and vice versa; the intent is to collect “clean” data that is exclusive to the hotels studied and unencumbered by unrelated properties.

Walker recorded parking space inventory and occupancies, as well as total room counts and room occupancies for multiple survey days, specifically targeting overnight parking-space occupancy rates during each night of the week. As a result, Walker performed 35 total observations over the seven survey days, which were as follows:

- September 21, 2019 (Friday night);
- December 29, 2019 (Saturday night);
- December 30, 2019 (Sunday night);
- February 4, 2020 (Monday night);
- February 5, 2020 (Tuesday night);
- February 6, 2020 (Wednesday night); and
- February 7, 2020 (Thursday night).

Vehicles were surveyed across the overnight hours (between 12:45 a.m. to 2:15 a.m.) to ensure that cars counted were hotel-use only and not impacted by other land uses, and to also reflect a typical peak-hour parking occupancy rate for hotel guest rooms.

Room occupancies (%) were sought by phone and in-person site visits. The hotel-guest-room occupancy data is provided as supplemental data and does not influence the observed demand ratios.

The data collected is plotted in Figure 1. The X-axis represents the seven days of the week, one representing each day of the data collection dates. The Y-axis is the number of parked cars observed around the 1 a.m. hour per hotel guest room, for each of the five hotels.

A shown in Figure 1, the data points range from a low of 0.05 to a high of 0.76 parked cars per hotel guest room. As can be seen, 25 of the 35 observations, or 71 percent, fall within the 0.20 to 0.50 band. Six data points are between 0.60 to 0.80 parked cars per hotel guest room and four data points are below 0.20 parked cars per hotel guest room.

The 50th percentile (median) observation is 0.39 parked cars per hotel guest room. The 85th percentile observation, the industry standard for informing parking supply recommendations, is 0.58 parked cars per hotel guest room. The 95th percentile observation, which exceeds the industry standard for parking supply recommendations, is 0.67 parked cars per hotel guest room.

Figure 1. Observed Number of Parked Cars per Hotel Guest Room.
### Appendix – Field Data Collection

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Overnight Hotel Parking Occupancy Survey – ±1 a.m. on September 21, 2019 (Friday night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel A</td>
<td>163</td>
</tr>
<tr>
<td>Hotel B</td>
<td>141</td>
</tr>
<tr>
<td>Hotel C</td>
<td>129</td>
</tr>
<tr>
<td>Hotel D</td>
<td>84</td>
</tr>
<tr>
<td>Hotel E</td>
<td>220</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Overnight Hotel Parking Occupancy Survey – ±1 a.m. on December 29, 2019 (Saturday night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel A</td>
<td>163</td>
</tr>
<tr>
<td>Hotel B</td>
<td>173</td>
</tr>
<tr>
<td>Hotel C</td>
<td>129</td>
</tr>
<tr>
<td>Hotel D</td>
<td>84</td>
</tr>
<tr>
<td>Hotel E</td>
<td>220</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Overnight Hotel Parking Occupancy Survey – ±1 a.m. on December 30, 2019 (Sunday night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel A</td>
<td>163</td>
</tr>
<tr>
<td>Hotel B</td>
<td>173</td>
</tr>
<tr>
<td>Hotel C</td>
<td>129</td>
</tr>
<tr>
<td>Hotel D</td>
<td>84</td>
</tr>
<tr>
<td>Hotel E</td>
<td>220</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Overnight Hotel Parking Occupancy Survey – ±1 a.m. on February 4, 2019 (Monday night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel A</td>
<td>163</td>
</tr>
<tr>
<td>Hotel B</td>
<td>173</td>
</tr>
<tr>
<td>Hotel C</td>
<td>129</td>
</tr>
<tr>
<td>Hotel D</td>
<td>84</td>
</tr>
<tr>
<td>Hotel E</td>
<td>220</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5</th>
<th>Overnight Hotel Parking Occupancy Survey – ±1 a.m. on February 5, 2019 (Tuesday night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel A</td>
<td>163</td>
</tr>
<tr>
<td>Hotel B</td>
<td>173</td>
</tr>
<tr>
<td>Hotel C</td>
<td>129</td>
</tr>
<tr>
<td>Hotel D</td>
<td>84</td>
</tr>
<tr>
<td>Hotel E</td>
<td>220</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 6</th>
<th>Overnight Hotel Parking Occupancy Survey – ±1 a.m. on February 6, 2019 (Wednesday night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel A</td>
<td>163</td>
</tr>
<tr>
<td>Hotel B</td>
<td>173</td>
</tr>
<tr>
<td>Hotel C</td>
<td>129</td>
</tr>
<tr>
<td>Hotel D</td>
<td>84</td>
</tr>
<tr>
<td>Hotel E</td>
<td>220</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 7</th>
<th>Overnight Hotel Parking Occupancy Survey – ±1 a.m. on February 7, 2019 (Thursday night)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hotel A</td>
<td>163</td>
</tr>
<tr>
<td>Hotel B</td>
<td>173</td>
</tr>
<tr>
<td>Hotel C</td>
<td>129</td>
</tr>
<tr>
<td>Hotel D</td>
<td>84</td>
</tr>
<tr>
<td>Hotel E</td>
<td>220</td>
</tr>
</tbody>
</table>

Source: Walker Consultants, 2019-2020
The hotel room occupancies averaged 84 percent for 27 studies (5 hotels x 7 days, less 8 occupancies that hotel operators were unwilling to provide), exceeding the U.S. national average of 66.2 percent occupancy.¹

Based on number of occupied hotel guest rooms, the 27 field data observations range from a low of 0.09 to a high of 1.05 parked cars per occupied hotel guest room. The 50th percentile (median) and mean observations are 0.45 and 0.51 parked cars per occupied hotel guest room, respectively. The 85th and 95th percentile observations are 0.70 and 0.88 parked cars per occupied guest room, respectively.

Data Limitations
This analysis is applicable for limited-service hotels in suburban locations. Ancillary hotel uses including conference and meeting room space, restaurants, spas, casinos, golf courses, etc. would be additive to the base ratios studied herein.

Conclusions
Based upon the information gathered and the available data analyzed, the parking supply ratio for the limited-service hotel guest room component can potentially be reduced from the required one space per room to 0.58 spaces per room. Note that this is applicable for a suburban location and that the increased reliance on ride-apps such as Uber and Lyft have decreased on-site demand for parking spaces. Other studies are encouraged and documented to build on this research and to inform a more fully-developed view of this topic.

References

For the last three decades, John Dorsett, AICP, senior vice president and managing director of Walker Consultants’ parking and mobility planning, operations, and technology practice, has successfully delivered or led the delivery of thousands of consulting engagements for architects, airports, hospitals, municipalities, real estate developers and universities located in all 50 U.S. states and several foreign countries. Consulting engagements have helped improve quality of life and users’ experiences, minimized project waste, and saved developers millions of dollars through right-sizing parking capacity, and supported the financing of billions of dollars in real estate development projects.
ITE Publications Bookshelf

Must-Have Publications for Transportation Planners and Those Working on Complete Streets Projects

Designing Walkable Urban Thoroughfares: A Context Sensitive Approach
Transit and Traffic Impact Studies - State of the Practice
Curbside Management Practitioners Guide
Traffic Calming Fact Sheets
Designing Walkable Urban Thoroughfares: A Context Sensitive Approach
Pedestrian and Bicyclist Safety in Parking Facilities
Recommended Design Guidelines to Accommodate Pedestrians and Bicycles at Interchanges: An ITE Recommended Practice
What a Transportation Professional Needs to Know about Counts and Studies during a Pandemic
Sustainable Traffic Signal Development: An Informational Report of the Institute of Transportation Engineers
Transit and Traffic Impact Studies State of the Practice: An Informational Report of the Institute of Transportation Engineers

More information and to purchase: www.ite.org/publications

Answer to the “Where in the World” on page 10: SR-14, Harrisburg, AR, USA. Photo submitted by Nathan Vatter (M).

In an age where information is everywhere, ITE members can look to ITE Spotlite to deliver timely news.

ITE’s bi-weekly e-newsletter has a sharpened focus on the news and trends in surface transportation that matter most to you.

To subscribe to the e-newsletter, email hstowell@ite.org.
All current ITE members receive the e-newsletter.
Congratulations to ITE’s New Districts and Sections

We look forward to an exciting year ahead!

Welcome to our New Sections!

From the Mountain District
Idaho Section
Montana Section
Nevada Section
Utah Section

From the Missouri Valley District
Arkansas Section
Central Missouri Section
Gateway Section Section
Iowa Section
Kansas Section
Nebraska Section
Oklahoma Section
Ozarks Section

From the Florida Puerto Rico District
Central Northeast Florida
Florida Panhandle
Greater Tampa
South Florida
ITS PLUS makes it easy to take advantage of ever expanding, high-performance, multi-patented vehicle detection products. This includes our unique and value added optical mask and circle zone technologies that provide radar and thermal-like performance at a fraction of the price.

A complete 4-way intersection is only $8,995.

Find out why everyone is talking about ITS PLUS at www.itsplus3.com

All ITS Plus products are designed and manufactured in the USA.